



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 6  
1445 ROSS AVENUE, SUITE 1200  
DALLAS, TX 75202-2733

October 16, 2015

(b) (6)

RE: Wilcox Oil Company Superfund Site – Residential Data Results

Dear Mr. and Mrs. (b) (6)

I am writing this letter to provide you with a summary of the soil data results for your property. Based on our review of the data collected, soil samples collected from your property did not exceed levels considered acceptable by EPA for short-term exposures. For long term exposures, concentrations fell within the accepted range established by EPA.

Table 1 presents the results for those chemicals detected in the soil and exceeding the RSL. Two metals and one organic chemical were detected at levels that exceed the RSL. All other data fell below the RSL. Arsenic was detected in every sample with the highest result being 4.7 milligrams per kilogram (mg/kg) at a depth of 0 – 2 inches below ground surface (bgs) while iron was detected in sample Grid 2 at a depth of 0-2 inches bgs at 72,700 mg/kg. Published reports have documented the background range of arsenic concentrations for Oklahoma as being 0.6 to 21 mg/kg. The highest result of 6.3 mg/kg falls within the range of background concentrations. One Polycyclic Aromatic Hydrocarbon, benzo(a)pyrene, was detected in sample Grid 6 at a depth of 2 - 6 inches below ground surface and at a concentration of 0.018 mg/kg.

Grid	Depth	Chemical	Concentration mg/kg	Screening Level mg/kg
Grid 2	0 – 2 inches bgs	Iron	72,000	55,000
Grid 6	2 – 6 inches bgs	Benzo(a)pyrene	0.018	0.016

The Residential Soil Screening Levels represent conservative levels developed using risk assessment guidance from the EPA Superfund program. RSLs are considered by the Agency to be protective for humans (including sensitive groups) over a lifetime of exposure. RSLs are not cleanup standards and are used for site "screening" to help identify areas, contaminants, and conditions that may require further investigation at a particular site. Generally, at sites where contaminant concentrations fall below RSLs, no further action or study is warranted under the Superfund program, so long as the exposure assumptions at a site match those used to develop the RSL. Chemical concentrations above the RSL do not automatically trigger a response action; however, exceeding the RSL suggests that further evaluation of the potential risks by site contaminants is appropriate. In addition, further evaluation of the potential risks related to site contaminants that were detected in the soil but have no RSL is appropriate. As we move forward with our site investigation, we will be evaluating these contaminants in more detail through a Site-specific Human Health Risk Assessment to determine the potential risks these contaminants

may pose. For additional information related to Arsenic and Polycyclic Aromatic Hydrocarbons, please see the enclosed contaminant profiles developed by the Agency for Toxic Substances and Disease Registry (ATSDR).

If you are concerned, please consider some of these options while we evaluate these contaminants in more detail.

- Ensure proper hygiene, especially frequent hand washing.
- Soil should be thoroughly shaken off clothes and footwear, before entering homes.
- Use a dust mask when mowing.
- Limit outside digging and soil moving activities.

We would like to follow-up with you during the week of October 26, 2015, to discuss the data presented in this letter and answer any questions that you may have. We will contact you by phone to schedule a time that fits your schedule. In the interim, should you want to talk with us, please contact me at 214-665-8143, or 1-800-533-3508, or contact Todd Downham, Oklahoma Department of Environmental Quality at 405-702-5136.

Sincerely,

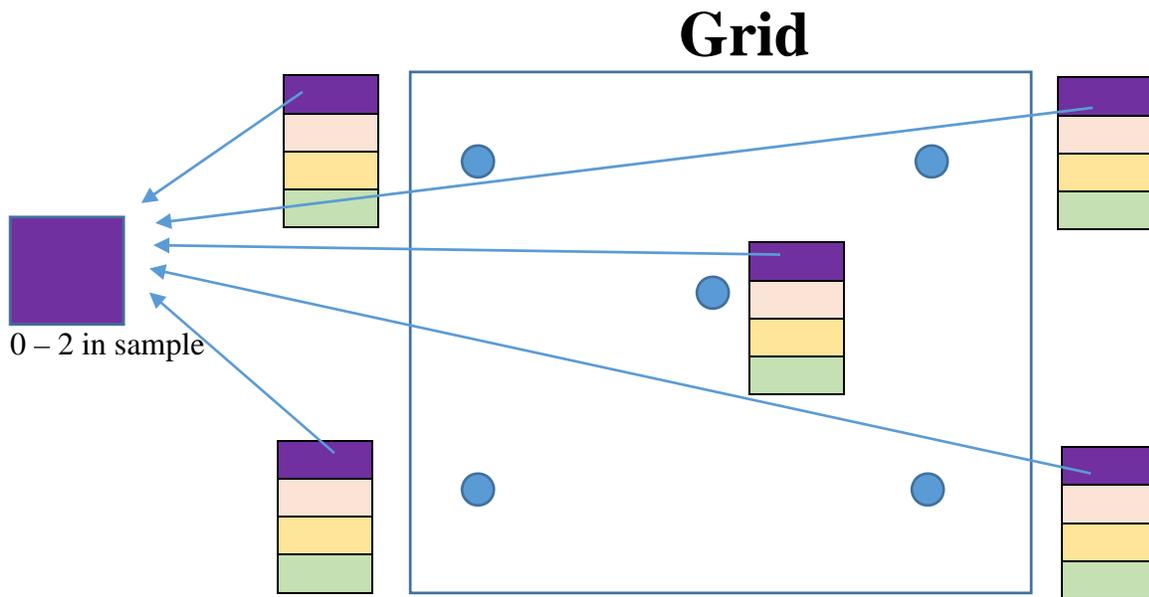


Katrina Higgins-Coltrain,  
Remedial Project Manager  
LA/OK/NM Section

## Enclosure 1: Understanding the Soil Collection Process

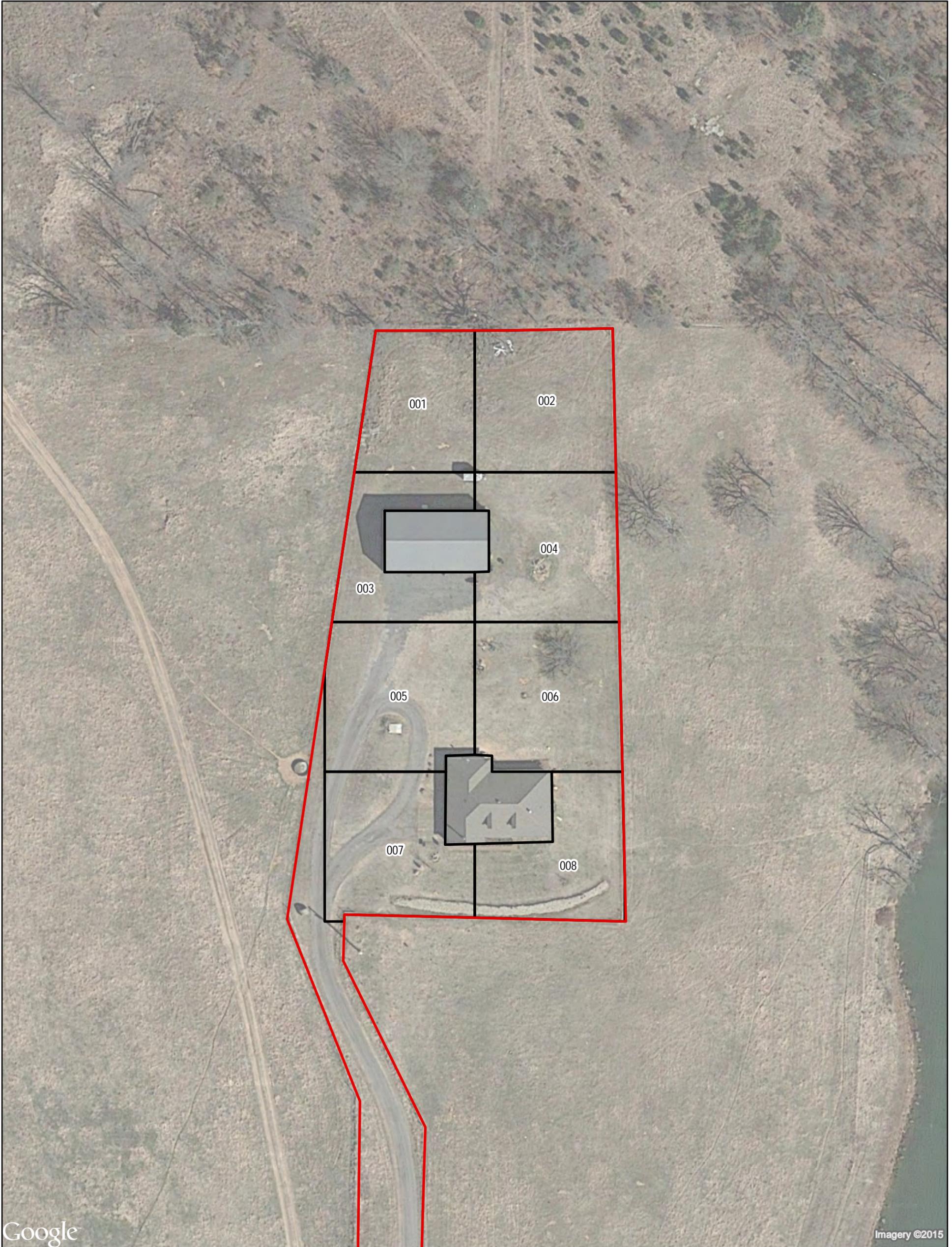
The following summary is provided to help you better understand how we sampled your property. The figure provided as Enclosure 2 shows that your property was divided into several sample grids. As shown in Figure 2, each Grid has five sample locations. From each of these five locations, a 24 inch long soil core was taken. The soil core was divided into depth intervals of 0-2 inches below ground surface (bgs), 2-6 inches bgs, 6-12 inches bgs, and 12-24 inches bgs. The soil from each depth interval was combined together to produce one sample representing that depth interval. For example, soil from 0-2 inches bgs was collected from each of the five sample locations and then combined into one sample that represents the 0-2 inch depth interval for that Grid. This process was used for each depth interval and results in a total of 4 soil samples for each Grid. One sample represents the 0-2 inches bgs, the second represents 2-6 inches bgs, the third represents 6-12 inches bgs, and the fourth represents 12-24 inches bgs. Figure 2 shows an example of the sample process. If there is no sample result for a depth interval, then we were not able to collect that sample due to little soil recovery or the core could not be pushed deeper because of rock. The table provided in Enclosure 3 summarizes the data results for all chemicals detected in the soil and provides the full list of chemicals that were analyzed. If a chemical is not summarized, then that chemical was not detected in the soil.

**Figure 2: Example of Soil Collection Process**



● Sample location

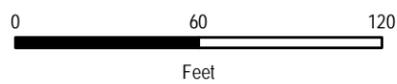
Depths for each Sample Location	
	0 – 2 inches below ground surface (bgs)
	2 – 6 inches bgs
	6 – 12 inches bgs
	12 – 24 inches bgs



Google

Imagery ©2015

- LEGEND**
- Property Boundary
  - Sample Grid Location



**US EPA REGION 6**

PROPERTY 019  
 SAMPLE LOCATION MAP  
 WILCOX OIL  
 WEST 221st STREET/REFINERY ROAD  
 BRISTOW, CREEK COUNTY, OKLAHOMA

TDD NO: 5/WESTON-042-15-004

SOURCE: 2010 Microsoft Corporation and its data suppliers

DATE  
OCTOBER, 2015

PROJECT NO  
20406.012.005.0919.01

SCALE  
AS SHOWN

**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 1 0-2in bgs 6/3/2015	Grid 1-Duplicate 0-2in bgs 6/3/2015	Grid 1 2-6in bgs 6/3/2015	Grid 2 0-2in bgs 6/3/2015	Grid 2 2-6in bgs 6/3/2015
<b>Metals</b>									
Aluminum	7429-90-5	mg/kg	77000	--	2740	2110	3800	2520	5050
Arsenic	7440-38-2	mg/kg	0.68	--	1.2	1.1	1.3	1	1.8
Barium	7440-39-3	mg/kg	15000	--	31.9	40	39.6	30.2	37.2
Calcium	7440-70-2	mg/kg	NP	--	494 U	558	503	1340	610
Chromium	7440-47-3	mg/kg	NP	--	6.3	5.8	9.3	6.4	9.9
Cobalt	7440-48-4	mg/kg	23	--	1.8	1.4	1.7	1.5	2
Copper	7440-50-8	mg/kg	3100	--	2.2	2	2.3	2.3	2.5
Iron	7439-89-6	mg/kg	55000	--	4170	3570	4710	72700	6500
Lead	7439-92-1	mg/kg	400	--	9.6	9.2	5.2	8.1	7.8
Magnesium	7439-95-4	mg/kg	NP	--	494 U	494 U	432 U	442 U	483
Manganese	7439-96-5	mg/kg	1800	--	107	97.9	85.2	335	87.8
Mercury	7439-97-6	mg/kg	9.4	--	0.016 LJ	0.013 LJ	0.012 LJ	0.0095 LJ	0.01 LJ
Nickel	7440-02-0	mg/kg	1500	--	3	2.6	4.4	3.5	4.7
Potassium	7440-09-7	mg/kg	NP	--	494 U	494 U	432 U	442 U	477
Selenium	7782-49-2	mg/kg	390	--	2.2 U	2.6 U	0.31 LJ	2.8 U	0.37 LJ
Vanadium	7440-62-2	mg/kg	390	--	10.4	9.5	15.3	10.3	16.9
Zinc	7440-66-6	mg/kg	23000	--	18.4	16.5	13.9	16.7	19.5



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Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 1 0-2in bgs 6/3/2015	Grid 1-Duplicate 0-2in bgs 6/3/2015	Grid 1 2-6in bgs 6/3/2015	Grid 2 0-2in bgs 6/3/2015	Grid 2 2-6in bgs 6/3/2015
<b>Polychlorinated Biphenyls (None Detected)</b>									
<b>Pesticides</b>									
4,4'-DDD	72-54-8	mg/kg	2.3	--	0.00026 LJ	0.00027 LJ	0.00039 LJ	0.00022 LJ	0.0017 LJ
4,4'-DDE	72-55-9	mg/kg	2	--	0.0042 U	0.0042 U	0.004 U	0.00029 LJ	0.00036 LJ
4,4'-DDT	50-29-3	mg/kg	1.9	--	0.0042 U	0.00059 LJ	0.00017 LJ	0.00038 LJ	0.00065 LJ
Aldrin	309-00-2	mg/kg	0.039	--	0.00081 LJ	0.0022 U	0.0021 U	0.0021 U	0.002 U
alpha-BHC	319-84-6	mg/kg	0.086	--	0.0022 U	0.0022 U	0.0021 U	0.0021 U	0.002 U
alpha-Chlordane	5103-71-9	mg/kg	NP	--	0.0022 U	0.0022 U	0.0021 U	0.0021 U	0.002 U
beta-BHC	319-85-7	mg/kg	0.3	--	0.0022 U	0.0022 U	0.0021 U	0.0021 U	0.0036 J
Dieldrin	60-57-1	mg/kg	0.034	--	0.00026 LJ	0.00027 LJ	0.00029 LJ	0.00015 LJ	0.00026 LJ
Endosulfan II	33213-65-9	mg/kg	NP	--	0.000021 LJ	0.0042 U	0.004 U	0.00026 LJ	0.0038 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	0.0042 U	0.0042 U	0.004 U	0.004 U	0.0038 U
Endrin	72-20-8	mg/kg	19	--	0.0042 U	0.00035 LJ	0.00083 LJ	0.0021 LJ	0.00056 LJ
Endrin aldehyde	7421-93-4	mg/kg	NP	--	0.00066 LJ	0.001 LJ	0.00028 LJ	0.001 LJ	0.0002 LJ
Endrin ketone	53494-70-5	mg/kg	NP	--	0.0042 U	0.0042 U	0.004 U	0.004 U	0.0038 U
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	0.00023 LJ	0.00022 LJ	0.00025 LJ	0.00015 LJ	0.00025 LJ
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.00017 LJ	0.00023 LJ	0.00017 LJ	0.00019 LJ	0.00017 LJ
Heptachlor	76-44-8	mg/kg	0.13	--	0.0022 U	0.0022 U	0.0021 U	0.0021 U	0.002 U
Heptachlor epoxide	1024-57-3	mg/kg	0.07	--	0.0022 U	0.0022 U	0.0021 U	0.0021 U	0.002 U
Methoxychlor	72-43-5	mg/kg	320	--	0.00066 LJ	0.0023 LJ	0.021 U	0.0026 LJ	0.0017 LJ



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<b>Semi-volatile Organic Compounds</b>									
4-Methylphenol	106-44-5	mg/kg	6300	--	<b>0.08 LJ</b>	0.22 UJ	0.21 UR	0.2 UR	0.2 UJ
4-Nitroaniline	100-01-6	mg/kg	27	--	0.42 UJ	<b>0.052 LJ</b>	0.4 UJ	0.4 UJ	0.38 UJ
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	0.22 UJ	0.22 UJ	<b>0.12 LJ</b>	0.2 UJ	<b>0.11 LJ</b>
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.22 UJ	0.22 UJ	0.21 UJ	0.2 UJ	0.2 UJ
<b>Semi-volatile Organic Compounds (SIM)</b>									
2-Methylnaphthalene	91-57-6	mg/kg	240	--	0.0042 UJ	0.0042 UJ	0.004 UJ	0.004 UJ	0.0038 UJ
Acenaphthylene	208-96-8	mg/kg	NP	--	<b>0.0021 LJ</b>	<b>0.0042 LJ</b>	0.004 UJ	0.004 UJ	0.0038 UJ
Anthracene	120-12-7	mg/kg	18000	--	<b>0.0018 LJ</b>	<b>0.0036 LJ</b>	0.004 UJ	0.004 UJ	0.0038 UJ
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	<b>0.0065 J</b>	<b>0.016 J</b>	<b>0.0014 LJ</b>	<b>0.0023 LJ</b>	<b>0.00087 LJ</b>
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	<b>0.005 J</b>	<b>0.011 J</b>	<b>0.0012 LJ</b>	<b>0.0017 LJ</b>	0.0038 UJ
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	<b>0.0094 J</b>	<b>0.019 J</b>	<b>0.0026 LJ</b>	<b>0.003 LJ</b>	<b>0.0012 LJ</b>
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	<b>0.0014 LJ</b>	<b>0.0022 LJ</b>	0.004 UJ	0.004 UJ	0.0038 UJ
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	<b>0.0031 LJ</b>	<b>0.0067 J</b>	0.004 UJ	<b>0.00095 LJ</b>	0.0038 UJ
Chrysene	218-01-9	mg/kg	16	--	<b>0.0071 J</b>	<b>0.014 J</b>	<b>0.002 LJ</b>	<b>0.0028 LJ</b>	<b>0.0013 LJ</b>
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	<b>0.0012 LJ</b>	<b>0.0024 LJ</b>	0.004 UJ	0.004 UJ	0.0038 UJ
Fluoranthene	206-44-0	mg/kg	2400	--	<b>0.0083 J</b>	<b>0.018 J</b>	<b>0.0024 LJ</b>	<b>0.0037 LJ</b>	<b>0.0013 LJ</b>
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	<b>0.0052 J</b>	<b>0.01 J</b>	<b>0.0015 LJ</b>	<b>0.0018 LJ</b>	<b>0.00079 LJ</b>
Naphthalene	91-20-3	mg/kg	3.8	--	0.0042 UJ	0.0042 UJ	0.004 UJ	0.004 UJ	<b>0.00088 LJ</b>
Pentachlorophenol	87-86-5	mg/kg	1	--	0.0086 UJ	0.0086 UJ	0.0081 UJ	0.008 UJ	0.0077 UJ
Phenanthrene	85-01-8	mg/kg	NP	--	<b>0.0026 LJ</b>	<b>0.0034 LJ</b>	<b>0.0015 LJ</b>	<b>0.0021 LJ</b>	<b>0.001 LJ</b>
Pyrene	129-00-0	mg/kg	1800	--	<b>0.01 J</b>	<b>0.019 J</b>	<b>0.0025 LJ</b>	<b>0.0037 LJ</b>	<b>0.0014 LJ</b>



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 1 0-2in bgs 6/3/2015	Grid 1-Duplicate 0-2in bgs 6/3/2015	Grid 1 2-6in bgs 6/3/2015	Grid 2 0-2in bgs 6/3/2015	Grid 2 2-6in bgs 6/3/2015
<b>Volatile Organic Compounds</b>									
2-Butanone	78-93-3	mg/kg	27000	--	0.017 U	0.014 U	<b>0.012</b>	0.011 U	0.011 U
Acetone	67-64-1	mg/kg	61000	--	<b>0.015 LJ</b>	<b>0.0086 LJ</b>	<b>0.025</b>	<b>0.011 LJ</b>	<b>0.02</b>
Ethylbenzene	100-41-4	mg/kg	5.8	--	0.0083 U	0.007 U	0.005 U	0.0055 U	0.0053 U
m,p-Xylene	108-38-3/106-42-3	mg/kg	550	--	<b>0.0006 LJ</b>	0.007 U	<b>0.00023 LJ</b>	0.0055 U	0.0053 U
o-Xylene	95-47-6	mg/kg	650	--	0.0083 U	0.007 U	0.005 U	0.0055 U	0.0053 U
Toluene	108-88-3	mg/kg	4900	--	<b>0.017 J</b>	<b>0.0073</b>	<b>0.0017 LJ</b>	<b>0.0011 LJ</b>	<b>0.0067</b>

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL

Yellow highlighted cells exceed RSL

U - Not Detected at reported quantitation limit

L - Reported concentration is below the CRQL

mg/kg-milligrams per kilogram

BOLD-indicates a detected concentration

bgs-below ground surface

NA - Not Analyzed

NP - Not Published

J - Estimated Value

R - Unusable

SIM-selected ion monitoring

in-inches



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

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<b>Metals</b>									
Aluminum	7429-90-5	mg/kg	77000	--	2610	2920	2490	3640	4460
Arsenic	7440-38-2	mg/kg	0.68	--	1.3 J	1.2 J	0.87 J	1.4 J	1.5 J
Barium	7440-39-3	mg/kg	15000	--	30.7	48.3	24.5	43.1	42.7
Calcium	7440-70-2	mg/kg	NP	--	1220	1240	1000	1300	1170
Chromium	7440-47-3	mg/kg	NP	--	6.7	5.6	5	7	8.9
Cobalt	7440-48-4	mg/kg	23	--	1.5	1.3	0.99	2.1	2.1
Copper	7440-50-8	mg/kg	3100	--	2.9	3.2	2.3	7.6	7.3
Iron	7439-89-6	mg/kg	55000	--	3330	3620	3100	9360	5820
Lead	7439-92-1	mg/kg	400	--	8.8	7.9	6.6	18.5	14.4
Magnesium	7439-95-4	mg/kg	NP	--	339 LJ	386 LJ	374 LJ	531	509 LJ
Manganese	7439-96-5	mg/kg	1800	--	69.1	83	65.3	1530	98.3
Mercury	7439-97-6	mg/kg	9.4	--	0.011 LJ	0.0081 LJ	0.0096 LJ	0.01 LJ	0.011 LJ
Nickel	7440-02-0	mg/kg	1500	--	3	2.7	2.3	4.8	4.9
Potassium	7440-09-7	mg/kg	NP	--	518 U	448	394 U	498	559 U
Selenium	7782-49-2	mg/kg	390	--	2.7 U	2.4 U	2.4 U	2.2 U	2.2 U
Vanadium	7440-62-2	mg/kg	390	--	10	8.3	6.9	11.1	14.6
Zinc	7440-66-6	mg/kg	23000	--	34.3	35.4	28.1	61.1	58.3



**Wilcox Oil  
Soil Analytical Data  
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<b>Polychlorinated Biphenyls (None Detected)</b>									
<b>Pesticides</b>									
4,4'-DDD	72-54-8	mg/kg	2.3	--	0.0041 U	0.0041 U	<b>0.00078 LJ</b>	<b>0.00071 LJ</b>	0.0037 U
4,4'-DDE	72-55-9	mg/kg	2	--	0.0041 U	<b>0.000028 LJ</b>	<b>0.00015 LJ</b>	<b>0.0022 LJ</b>	<b>0.00033 LJ</b>
4,4'-DDT	50-29-3	mg/kg	1.9	--	<b>0.00048 LJ</b>	<b>0.00072 LJ</b>	<b>0.0012 LJ</b>	<b>0.0024 LJ</b>	<b>0.00019 LJ</b>
Aldrin	309-00-2	mg/kg	0.039	--	<b>0.0005 LJ</b>	0.0021 U	0.0021 U	<b>0.0031 J</b>	<b>0.00025 LJ</b>
alpha-BHC	319-84-6	mg/kg	0.086	--	<b>0.00012 LJ</b>	<b>0.000082 LJ</b>	<b>0.000084 LJ</b>	<b>0.00011 LJ</b>	0.0019 U
alpha-Chlordane	5103-71-9	mg/kg	NP	--	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0019 U
beta-BHC	319-85-7	mg/kg	0.3	--	<b>0.0001 LJ</b>	<b>0.00036 LJ</b>	<b>0.002 LJ</b>	<b>0.0051</b>	0.0019 U
Dieldrin	60-57-1	mg/kg	0.034	--	<b>0.00032 LJ</b>	<b>0.0003 LJ</b>	<b>0.00007 LJ</b>	<b>0.00027 LJ</b>	<b>0.00024 LJ</b>
Endosulfan II	33213-65-9	mg/kg	NP	--	<b>0.000089 LJ</b>	0.0041 U	0.0041 U	0.0041 U	0.0037 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	0.0041 U	0.0041 U	0.0041 U	0.0041 U	0.0037 U
Endrin	72-20-8	mg/kg	19	--	<b>0.0013 LJ</b>	<b>0.00084 LJ</b>	<b>0.0028 LJ</b>	<b>0.0034 LJ</b>	<b>0.0007 LJ</b>
Endrin aldehyde	7421-93-4	mg/kg	NP	--	<b>0.00045 LJ</b>	<b>0.0006 LJ</b>	<b>0.00057 LJ</b>	<b>0.0011 LJ</b>	<b>0.00031 LJ</b>
Endrin ketone	53494-70-5	mg/kg	NP	--	<b>0.00008 LJ</b>	<b>0.00025 LJ</b>	<b>0.00094 LJ</b>	<b>0.0016 LJ</b>	0.0037 U
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	0.0021 U	<b>0.000099 LJ</b>	0.0021 U	<b>0.00052 LJ</b>	0.0019 U
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.0021 U	0.0021 U	0.0021 U	<b>0.00014 LJ</b>	0.0019 U
Heptachlor	76-44-8	mg/kg	0.13	--	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0019 U
Heptachlor epoxide	1024-57-3	mg/kg	0.07	--	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0019 U
Methoxychlor	72-43-5	mg/kg	320	--	<b>0.00065 LJ</b>	<b>0.00049 LJ</b>	0.021 U	<b>0.00029 LJ</b>	<b>0.0013 LJ</b>



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 3 0-2in bgs 6/4/2015	Grid 3-Duplicate 0-2in bgs 6/4/2015	Grid 3 2-6in bgs 6/4/2015	Grid 4 0-2in bgs 6/4/2015	Grid 4 2-6in bgs 6/4/2015
<b>Semi-volatile Organic Compounds</b>									
4-Methylphenol	106-44-5	mg/kg	6300	--	0.21 U	0.21 U	0.21 U	0.21 U	0.19 U
4-Nitroaniline	100-01-6	mg/kg	27	--	0.41 U	0.41 U	0.41 U	0.41 U	0.38 U
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	0.21 U	0.21 U	<b>0.37</b>	0.21 U	<b>0.15 LJ</b>
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.21 U	0.21 U	0.21 U	0.21 U	0.19 U
<b>Semi-volatile Organic Compounds (SIM)</b>									
2-Methylnaphthalene	91-57-6	mg/kg	240	--	<b>0.00098 LJ</b>	0.0041 U	<b>0.0013 LJ</b>	<b>0.0011 LJ</b>	0.0038 U
Acenaphthylene	208-96-8	mg/kg	NP	--	<b>0.0029 LJ</b>	<b>0.0018 LJ</b>	<b>0.0034 LJ</b>	<b>0.00099 LJ</b>	0.0038 U
Anthracene	120-12-7	mg/kg	18000	--	<b>0.0037 LJ</b>	<b>0.0027 LJ</b>	<b>0.0054</b>	<b>0.0011 LJ</b>	0.0038 U
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	<b>0.007</b>	<b>0.0041 LJ</b>	<b>0.0082</b>	<b>0.0037 LJ</b>	<b>0.0021 LJ</b>
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	<b>0.006</b>	<b>0.0042</b>	<b>0.0069</b>	<b>0.0034 LJ</b>	<b>0.0019 LJ</b>
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	<b>0.014</b>	<b>0.01</b>	<b>0.021</b>	<b>0.0067</b>	<b>0.0042</b>
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	<b>0.0048</b>	0.0041 U	<b>0.0038 LJ</b>	<b>0.00096 LJ</b>	<b>0.0022 LJ</b>
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	<b>0.004 LJ</b>	<b>0.0029 LJ</b>	<b>0.0055</b>	<b>0.0018 LJ</b>	<b>0.00098 LJ</b>
Chrysene	218-01-9	mg/kg	16	--	<b>0.01</b>	<b>0.0064</b>	<b>0.017</b>	<b>0.0063</b>	<b>0.0033 LJ</b>
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	<b>0.0015 LJ</b>	<b>0.0011 LJ</b>	<b>0.0019 LJ</b>	<b>0.0011 LJ</b>	0.0038 U
Fluoranthene	206-44-0	mg/kg	2400	--	<b>0.011</b>	<b>0.0065</b>	<b>0.029</b>	<b>0.0055</b>	<b>0.0032 LJ</b>
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	<b>0.0068</b>	<b>0.005</b>	<b>0.0086</b>	<b>0.0044</b>	<b>0.0024 LJ</b>
Naphthalene	91-20-3	mg/kg	3.8	--	0.0041 U	0.0041 U	<b>0.00089 LJ</b>	<b>0.0009 LJ</b>	0.0038 U
Pentachlorophenol	87-86-5	mg/kg	1	--	0.0082 UJv	0.0084 UJv	<b>0.0014 LJ</b>	0.0083 U	0.0076 UJv
Phenanthrene	85-01-8	mg/kg	NP	--	<b>0.0031 LJ</b>	<b>0.0023 LJ</b>	<b>0.0061</b>	<b>0.0043</b>	<b>0.0018 LJ</b>
Pyrene	129-00-0	mg/kg	1800	--	<b>0.012</b>	<b>0.0075</b>	<b>0.024</b>	<b>0.0079</b>	<b>0.0043</b>



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 3 0-2in bgs 6/4/2015	Grid 3-Duplicate 0-2in bgs 6/4/2015	Grid 3 2-6in bgs 6/4/2015	Grid 4 0-2in bgs 6/4/2015	Grid 4 2-6in bgs 6/4/2015
<b>Volatile Organic Compounds</b>									
2-Butanone	78-93-3	mg/kg	27000	--	0.012 U	0.014 U	0.013 U	0.017 U	0.011 U
Acetone	67-64-1	mg/kg	61000	--	0.012 U	<b>0.013 LJ</b>	0.013 U	<b>0.012 LJ</b>	0.011 U
Ethylbenzene	100-41-4	mg/kg	5.8	--	0.0062 U	0.0072 U	0.0065 U	0.0087 U	0.0055 U
m,p-Xylene	108-38-3/106-42-3	mg/kg	550	--	0.0062 U	<b>0.00037 LJ</b>	0.0065 U	<b>0.00075 LJ</b>	0.0055 U
o-Xylene	95-47-6	mg/kg	650	--	0.0062 U	0.0072 U	0.0065 U	0.0087 U	0.0055 U
Toluene	108-88-3	mg/kg	4900	--	<b>0.0018 LJ</b>	<b>0.011 J</b>	<b>0.0055 LJ</b>	<b>0.0044 LJ</b>	<b>0.0042 LJ</b>

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL

Yellow highlighted cells exceed RSL

U - Not Detected at reported quantitation limit

L - Reported concentration is below the CRQL

mg/kg-milligrams per kilogram

BOLD-indicates a detected concentration

bgs-below ground surface

NA - Not Analyzed

NP - Not Published

J - Estimated Value

R - Unusable

SIM-selected ion monitoring

in-inches



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 5 0-2in bgs 6/4/2015	Grid 5-Duplicate 0-2in bgs 6/4/2015	Grid 5 2-6in bgs 6/4/2015	Grid 5 6-12in bgs 6/4/2015	Grid 5 12-24in bgs 6/4/2015
<b>Metals</b>									
Aluminum	7429-90-5	mg/kg	77000	--	3150	3790	4500	4320	2640
Arsenic	7440-38-2	mg/kg	0.68	--	2.4 J	2 J	1.1 J	1.2 J	1.2 J
Barium	7440-39-3	mg/kg	15000	--	37.6	39	29.1	37.8	30.6
Calcium	7440-70-2	mg/kg	NP	--	12100	17500	1550	1140	6990
Chromium	7440-47-3	mg/kg	NP	--	8.1	8.3	5.7	7.6	6.2
Cobalt	7440-48-4	mg/kg	23	--	2.7	2.4	1.7	2.4	1.9
Copper	7440-50-8	mg/kg	3100	--	4.8	4.4	3	3.1	4.1
Iron	7439-89-6	mg/kg	55000	--	6690	7780	4640	5530	4270
Lead	7439-92-1	mg/kg	400	--	9.2	13.6	9.1	6.2	10.4
Magnesium	7439-95-4	mg/kg	NP	--	704	916	479	579	337 LJ
Manganese	7439-96-5	mg/kg	1800	--	152	157	76.1	113	105
Mercury	7439-97-6	mg/kg	9.4	--	0.0047 LJ	0.0026 LJ	0.0034 LJ	0.0073 LJ	0.0049 LJ
Nickel	7440-02-0	mg/kg	1500	--	5.7	5.4	3.2	4.6	3.4
Potassium	7440-09-7	mg/kg	NP	--	575	572	546	578	430 U
Selenium	7782-49-2	mg/kg	390	--	1.9 U	1.8 U	2.2 U	2.7 U	2.6 U
Vanadium	7440-62-2	mg/kg	390	--	12.1	12.5	8.2	11	9.1
Zinc	7440-66-6	mg/kg	23000	--	35.3	41	30.1	25.5	29.3



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 5 0-2in bgs 6/4/2015	Grid 5-Duplicate 0-2in bgs 6/4/2015	Grid 5 2-6in bgs 6/4/2015	Grid 5 6-12in bgs 6/4/2015	Grid 5 12-24in bgs 6/4/2015
<b>Polychlorinated Biphenyls (None Detected)</b>									
<b>Pesticides</b>									
4,4'-DDD	72-54-8	mg/kg	2.3	--	0.0035 U	<b>0.00015 LJ</b>	0.0037 U	0.0036 U	<b>0.0003 LJ</b>
4,4'-DDE	72-55-9	mg/kg	2	--	<b>0.00048 LJ</b>	<b>0.00033 LJ</b>	<b>0.0001 LJ</b>	<b>0.00023 LJ</b>	<b>0.000024 LJ</b>
4,4'-DDT	50-29-3	mg/kg	1.9	--	<b>0.0011 LJ</b>	<b>0.00031 LJ</b>	<b>0.00086 LJ</b>	<b>0.0004 LJ</b>	<b>0.00064 LJ</b>
Aldrin	309-00-2	mg/kg	0.039	--	<b>0.000073 LJ</b>	<b>0.00035 LJ</b>	<b>0.0011 LJ</b>	<b>0.0014 LJ</b>	<b>0.0012 LJ</b>
alpha-BHC	319-84-6	mg/kg	0.086	--	0.0018 U	<b>0.000042 LJ</b>	0.0019 U	<b>0.000081 LJ</b>	<b>0.000063 LJ</b>
alpha-Chlordane	5103-71-9	mg/kg	NP	--	0.0018 U	<b>0.00017 LJ</b>	0.0019 U	0.0019 U	0.0019 U
beta-BHC	319-85-7	mg/kg	0.3	--	0.0018 U	<b>0.00011 LJ</b>	<b>0.00069 LJ</b>	<b>0.001 LJ</b>	<b>0.0016 LJ</b>
Dieldrin	60-57-1	mg/kg	0.034	--	<b>0.00036 LJ</b>	<b>0.00042 LJ</b>	<b>0.00015 LJ</b>	<b>0.00011 LJ</b>	<b>0.00013 LJ</b>
Endosulfan II	33213-65-9	mg/kg	NP	--	<b>0.00024 LJ</b>	<b>0.00017 LJ</b>	0.0037 U	0.0036 U	0.0037 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	<b>0.000035 LJ</b>	0.0034 U	0.0037 U	0.0036 U	0.0037 U
Endrin	72-20-8	mg/kg	19	--	<b>0.00086 LJ</b>	<b>0.00056 LJ</b>	<b>0.00057 LJ</b>	<b>0.00091 LJ</b>	<b>0.0016 LJ</b>
Endrin aldehyde	7421-93-4	mg/kg	NP	--	<b>0.00039 LJ</b>	<b>0.00017 LJ</b>	<b>0.00056 LJ</b>	<b>0.00019 LJ</b>	<b>0.00017 LJ</b>
Endrin ketone	53494-70-5	mg/kg	NP	--	<b>0.00047 LJ</b>	<b>0.00029 LJ</b>	<b>0.00025 LJ</b>	<b>0.0013 LJ</b>	<b>0.00029 LJ</b>
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	<b>0.000086 LJ</b>	<b>0.00015 LJ</b>	0.0019 U	0.0019 U	0.0019 U
gamma-Chlordane	5103-74-2	mg/kg	NP	--	<b>0.00015 LJ</b>	<b>0.00012 LJ</b>	<b>0.00015 LJ</b>	0.0019 U	0.0019 U
Heptachlor	76-44-8	mg/kg	0.13	--	0.0018 U	0.0018 U	<b>0.000069 LJ</b>	0.0019 U	0.0019 U
Heptachlor epoxide	1024-57-3	mg/kg	0.07	--	0.0018 U	0.0018 U	0.0019 U	0.0019 U	0.0019 U
Methoxychlor	72-43-5	mg/kg	320	--	<b>0.00096 LJ</b>	0.018 U	0.019 U	0.019 U	<b>0.0013 LJ</b>



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 5 0-2in bgs 6/4/2015	Grid 5-Duplicate 0-2in bgs 6/4/2015	Grid 5 2-6in bgs 6/4/2015	Grid 5 6-12in bgs 6/4/2015	Grid 5 12-24in bgs 6/4/2015
<b>Semi-volatile Organic Compounds</b>									
4-Methylphenol	106-44-5	mg/kg	6300	--	0.18 U	0.18 U	0.19 U	0.19 U	0.19 U
4-Nitroaniline	100-01-6	mg/kg	27	--	0.34 U	0.35 U	0.37 U	0.36 U	0.36 U
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	<b>0.025 LJ</b>	0.18 U	<b>0.14 LJ</b>	<b>0.12 LJ</b>	<b>0.13 LJ</b>
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.18 U	<b>0.015 LJ</b>	0.19 U	0.19 U	0.19 U
<b>Semi-volatile Organic Compounds (SIM)</b>									
2-Methylnaphthalene	91-57-6	mg/kg	240	--	<b>0.0019 LJ</b>	<b>0.001 LJ</b>	<b>0.0011 LJ</b>	<b>0.00097 LJ</b>	<b>0.00084 LJ</b>
Acenaphthylene	208-96-8	mg/kg	NP	--	<b>0.001 LJ</b>	<b>0.0013 LJ</b>	0.0037 U	<b>0.0011 LJ</b>	<b>0.0013 LJ</b>
Anthracene	120-12-7	mg/kg	18000	--	<b>0.0049</b>	<b>0.003 LJ</b>	<b>0.0011 LJ</b>	<b>0.0017 LJ</b>	<b>0.002 LJ</b>
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	<b>0.0045</b>	<b>0.0053</b>	<b>0.0023 LJ</b>	<b>0.0029 LJ</b>	<b>0.0036 LJ</b>
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	<b>0.0052</b>	<b>0.0044</b>	<b>0.002 LJ</b>	<b>0.0023 LJ</b>	<b>0.003 LJ</b>
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	<b>0.012</b>	<b>0.0093</b>	<b>0.0044</b>	<b>0.0061</b>	<b>0.0078</b>
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	<b>0.016</b>	<b>0.0057</b>	<b>0.0015 LJ</b>	<b>0.00079 LJ</b>	<b>0.00076 LJ</b>
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	<b>0.002 LJ</b>	<b>0.0023 LJ</b>	<b>0.0011 LJ</b>	<b>0.0018 LJ</b>	<b>0.002 LJ</b>
Chrysene	218-01-9	mg/kg	16	--	<b>0.0097</b>	<b>0.0067</b>	<b>0.0036 LJ</b>	<b>0.0043</b>	<b>0.0047</b>
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	<b>0.0026 LJ</b>	<b>0.0013 LJ</b>	0.0037 U	0.0036 U	0.0036 U
Fluoranthene	206-44-0	mg/kg	2400	--	<b>0.006</b>	<b>0.0062</b>	<b>0.0032 LJ</b>	<b>0.0051</b>	<b>0.0043</b>
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	<b>0.0077</b>	<b>0.0042</b>	<b>0.002 LJ</b>	<b>0.0021 LJ</b>	<b>0.0026 LJ</b>
Naphthalene	91-20-3	mg/kg	3.8	--	<b>0.0011 LJ</b>	<b>0.00075 LJ</b>	<b>0.00082 LJ</b>	<b>0.00074 LJ</b>	0.0036 U
Pentachlorophenol	87-86-5	mg/kg	1	--	0.007 UJv	0.007 UJv	0.0074 UJv	0.0074 UJv	0.0074 UJv
Phenanthrene	85-01-8	mg/kg	NP	--	<b>0.0044</b>	<b>0.0026 LJ</b>	<b>0.0019 LJ</b>	<b>0.0024 LJ</b>	<b>0.0018 LJ</b>
Pyrene	129-00-0	mg/kg	1800	--	<b>0.0091</b>	<b>0.0073</b>	<b>0.0045</b>	<b>0.0054</b>	<b>0.006</b>

**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 5 0-2in bgs 6/4/2015	Grid 5-Duplicate 0-2in bgs 6/4/2015	Grid 5 2-6in bgs 6/4/2015	Grid 5 6-12in bgs 6/4/2015	Grid 5 12-24in bgs 6/4/2015
<b>Volatile Organic Compounds</b>									
2-Butanone	78-93-3	mg/kg	27000	--	0.016 U	0.0099 U	0.011 U	0.012 U	0.013 U
Acetone	67-64-1	mg/kg	61000	--	0.016 U	<b>0.0059 LJ</b>	0.011 U	<b>0.0079 LJ</b>	<b>0.016</b>
Ethylbenzene	100-41-4	mg/kg	5.8	--	0.0081 U	0.0049 U	0.0057 U	0.0058 U	0.0066 U
m,p-Xylene	108-38-3/106-42-3	mg/kg	550	--	0.0081 U	0.0049 U	<b>0.00033 LJ</b>	0.0058 U	0.0066 U
o-Xylene	95-47-6	mg/kg	650	--	0.0081 U	0.0049 U	0.0057 U	0.0058 U	0.0066 U
Toluene	108-88-3	mg/kg	4900	--	<b>0.0022 LJ</b>	<b>0.003 LJ</b>	<b>0.0072</b>	0.0058 U	<b>0.0011 LJ</b>

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL

Yellow highlighted cells exceed RSL

U - Not Detected at reported quantitation limit

L - Reported concentration is below the CRQL

mg/kg-milligrams per kilogram

BOLD-indicates a detected concentration

bgs-below ground surface

NA - Not Analyzed

NP - Not Published

J - Estimated Value

R - Unusable

SIM-selected ion monitoring

in-inches



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 6 0-2in bgs 6/4/2015	Grid 6 2-6in bgs 6/4/2015	Grid 7 0-2in bgs 6/4/2015	Grid 7 2-6in bgs 6/4/2015	Grid 7 6-12in bgs 6/4/2015	Grid 7 12-24in bgs 6/4/2015
<b>Metals</b>										
Aluminum	7429-90-5	mg/kg	77000	--	4630	4330	2420	4730	10100	4840
Arsenic	7440-38-2	mg/kg	0.68	--	3.2 J	2.1 J	2 J	2.4 J	2.6 J	1.7 J
Barium	7440-39-3	mg/kg	15000	--	43.6	47.6	33.1	46.7	52.7	37.1
Calcium	7440-70-2	mg/kg	NP	--	1100	1110	2750	2900	1360	2800
Chromium	7440-47-3	mg/kg	NP	--	8	8.3	7.5	9.2	17.8	8.6
Cobalt	7440-48-4	mg/kg	23	--	2.3	2.4	2.2	3.2	3.1	2.1
Copper	7440-50-8	mg/kg	3100	--	4.8	5.5	3.2	3.6	6.5	4.5
Iron	7439-89-6	mg/kg	55000	--	5970	6230	5520	8050	11200	8210
Lead	7439-92-1	mg/kg	400	--	17.6	21.7	6	6.5	7.8	10.2
Magnesium	7439-95-4	mg/kg	NP	--	581	530	431	659	946	1390
Manganese	7439-96-5	mg/kg	1800	--	126	127	135	169	81.9	124
Mercury	7439-97-6	mg/kg	9.4	--	0.014 LJ	0.037 LJ	0.0041 LJ	0.0042 LJ	0.0026 LJ	0.0039 LJ
Nickel	7440-02-0	mg/kg	1500	--	4.5	4.8	4.1	6	8.9	5
Potassium	7440-09-7	mg/kg	NP	--	785	661	490	791	1050	642
Selenium	7782-49-2	mg/kg	390	--	2.4 U	2.2 U	2.5 U	2.3 U	0.31 LJ	2.5 U
Vanadium	7440-62-2	mg/kg	390	--	11.6	12.6	9.8	13.7	25.3	13.1
Zinc	7440-66-6	mg/kg	23000	--	40.9	58.4	19.8	17.3	25.9	33.9



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 6 0-2in bgs 6/4/2015	Grid 6 2-6in bgs 6/4/2015	Grid 7 0-2in bgs 6/4/2015	Grid 7 2-6in bgs 6/4/2015	Grid 7 6-12in bgs 6/4/2015	Grid 7 12-24in bgs 6/4/2015
<b>Polychlorinated Biphenyls (None Detected)</b>										
<b>Pesticides</b>										
4,4'-DDD	72-54-8	mg/kg	2.3	--	0.0037 U	<b>0.00012 LJ</b>	0.0036 U	0.0037 U	0.0037 U	0.0036 U
4,4'-DDE	72-55-9	mg/kg	2	--	<b>0.000093 LJ</b>	<b>0.0004 LJ</b>	<b>0.0003 LJ</b>	<b>0.000061 LJ</b>	<b>0.00018 LJ</b>	0.0036 U
4,4'-DDT	50-29-3	mg/kg	1.9	--	<b>0.00061 LJ</b>	<b>0.00081 LJ</b>	<b>0.0029 LJ</b>	<b>0.00024 LJ</b>	<b>0.00064 LJ</b>	<b>0.00073 LJ</b>
Aldrin	309-00-2	mg/kg	0.039	--	0.0019 U	<b>0.0022 J</b>	<b>0.00061 LJ</b>	<b>0.00057 LJ</b>	<b>0.00014 LJ</b>	<b>0.0003 LJ</b>
alpha-BHC	319-84-6	mg/kg	0.086	--	0.0019 U	<b>0.000066 LJ</b>	<b>0.00016 LJ</b>	<b>0.000055 LJ</b>	<b>0.000068 LJ</b>	<b>0.000054 LJ</b>
alpha-Chlordane	5103-71-9	mg/kg	NP	--	0.0019 U	0.0021 U	0.0019 U	0.0019 U	0.0019 U	0.0018 U
beta-BHC	319-85-7	mg/kg	0.3	--	<b>0.00018 LJ</b>	<b>0.0033</b>	0.0019 U	0.0019 U	0.0019 U	0.0018 U
Dieldrin	60-57-1	mg/kg	0.034	--	<b>0.0002 LJ</b>	<b>0.00051 LJ</b>	<b>0.00026 LJ</b>	<b>0.00024 LJ</b>	0.0037 U	<b>0.00017 LJ</b>
Endosulfan II	33213-65-9	mg/kg	NP	--	<b>0.00003 LJ</b>	0.0041 U	<b>0.00023 LJ</b>	<b>0.00017 LJ</b>	<b>0.0002 LJ</b>	<b>0.00034 LJ</b>
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	<b>0.00051 LJ</b>	0.0041 U	<b>0.00041 LJ</b>	<b>0.00014 LJ</b>	<b>0.000087 LJ</b>	<b>0.00047 LJ</b>
Endrin	72-20-8	mg/kg	19	--	<b>0.00044 LJ</b>	<b>0.00088 LJ</b>	<b>0.00094 LJ</b>	<b>0.001 LJ</b>	<b>0.00095 LJ</b>	<b>0.0011 LJ</b>
Endrin aldehyde	7421-93-4	mg/kg	NP	--	<b>0.00035 LJ</b>	<b>0.00019 LJ</b>	<b>0.00021 LJ</b>	<b>0.00019 LJ</b>	<b>0.00024 LJ</b>	<b>0.00016 LJ</b>
Endrin ketone	53494-70-5	mg/kg	NP	--	<b>0.00021 LJ</b>	<b>0.00099 LJ</b>	<b>0.00018 LJ</b>	<b>0.000024 LJ</b>	<b>0.00015 LJ</b>	<b>0.00019 LJ</b>
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	<b>0.00041 LJ</b>	0.0021 U	<b>0.00011 LJ</b>	0.0019 U	0.0019 U	<b>0.00023 LJ</b>
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.0019 U	<b>0.0003 LJ</b>	<b>0.00012 LJ</b>	<b>0.00011 LJ</b>	<b>0.00012 LJ</b>	<b>0.000051 LJ</b>
Heptachlor	76-44-8	mg/kg	0.13	--	0.0019 U	0.0021 U	0.0019 U	0.0019 U	0.0019 U	0.0018 U
Heptachlor epoxide	1024-57-3	mg/kg	0.07	--	<b>0.0001 LJ</b>	0.0021 U	0.0019 U	0.0019 U	0.0019 U	<b>0.00033 LJ</b>
Methoxychlor	72-43-5	mg/kg	320	--	0.019 U	<b>0.0022 LJ</b>	<b>0.001 LJ</b>	<b>0.0012 LJ</b>	0.019 U	<b>0.00044 LJ</b>



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 6 0-2in bgs 6/4/2015	Grid 6 2-6in bgs 6/4/2015	Grid 7 0-2in bgs 6/4/2015	Grid 7 2-6in bgs 6/4/2015	Grid 7 6-12in bgs 6/4/2015	Grid 7 12-24in bgs 6/4/2015
<b>Semi-volatile Organic Compounds</b>										
4-Methylphenol	106-44-5	mg/kg	6300	--	0.19 U	0.21 U	0.19 U	0.19 U	0.19 U	0.18 U
4-Nitroaniline	100-01-6	mg/kg	27	--	0.37 U	0.41 U	0.36 U	0.38 U	0.37 U	0.36 U
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	0.19 U	<b>0.21</b>	<b>0.032 LJ</b>	<b>0.26</b>	<b>0.09 LJ</b>	<b>0.12 LJ</b>
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.19 U	0.21 U	0.19 U	0.19 U	0.19 U	0.18 U
<b>Semi-volatile Organic Compounds (SIM)</b>										
2-Methylnaphthalene	91-57-6	mg/kg	240	--	<b>0.0011 LJ</b>	<b>0.0085 LJ</b>	<b>0.0042</b>	<b>0.0075</b>	0.0037 U	<b>0.00087 LJ</b>
Acenaphthylene	208-96-8	mg/kg	NP	--	<b>0.0014 LJ</b>	0.017 U	<b>0.00093 LJ</b>	<b>0.00083 LJ</b>	<b>0.0029 LJ</b>	<b>0.0012 LJ</b>
Anthracene	120-12-7	mg/kg	18000	--	<b>0.0023 LJ</b>	<b>0.0074 LJ</b>	<b>0.0011 LJ</b>	<b>0.001 LJ</b>	<b>0.0031 LJ</b>	<b>0.0013 LJ</b>
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	<b>0.0053</b>	<b>0.037</b>	<b>0.0028 LJ</b>	<b>0.0027 LJ</b>	<b>0.0081</b>	<b>0.0051</b>
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	<b>0.0042</b>	<b>0.018</b>	<b>0.0026 LJ</b>	<b>0.0018 LJ</b>	<b>0.007</b>	<b>0.0043</b>
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	<b>0.0087</b>	<b>0.024</b>	<b>0.006</b>	<b>0.0051</b>	<b>0.016</b>	<b>0.0089</b>
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	<b>0.0014 LJ</b>	<b>0.0042 LJ</b>	<b>0.0017 LJ</b>	0.0038 U	<b>0.00099 LJ</b>	0.0036 U
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	0.0037 U	<b>0.0059 LJ</b>	<b>0.0017 LJ</b>	<b>0.0015 LJ</b>	<b>0.0052</b>	<b>0.0027 LJ</b>
Chrysene	218-01-9	mg/kg	16	--	<b>0.0091</b>	<b>0.058</b>	<b>0.0043</b>	<b>0.0036 LJ</b>	<b>0.0097</b>	<b>0.0069</b>
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	<b>0.001 LJ</b>	<b>0.006 LJ</b>	0.0036 U	0.0038 U	<b>0.0014 LJ</b>	<b>0.00077 LJ</b>
Fluoranthene	206-44-0	mg/kg	2400	--	<b>0.0068</b>	<b>0.024</b>	<b>0.0035 LJ</b>	<b>0.0034 LJ</b>	<b>0.009</b>	<b>0.0065</b>
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	<b>0.0035 LJ</b>	<b>0.015 LJ</b>	<b>0.0025 LJ</b>	<b>0.0016 LJ</b>	<b>0.0056</b>	<b>0.0028 LJ</b>
Naphthalene	91-20-3	mg/kg	3.8	--	<b>0.0008 LJ</b>	0.017 U	<b>0.0017 LJ</b>	<b>0.0036 LJ</b>	0.0037 U	0.0036 U
Pentachlorophenol	87-86-5	mg/kg	1	--	0.0075 UJv	<b>0.0047 LJ</b>	0.0074 UJv	0.0076 UJv	0.0076 UJv	0.0072 UJv
Phenanthrene	85-01-8	mg/kg	NP	--	<b>0.0046</b>	<b>0.1</b>	<b>0.0018 LJ</b>	<b>0.0029 LJ</b>	<b>0.0026 LJ</b>	<b>0.003 LJ</b>
Pyrene	129-00-0	mg/kg	1800	--	<b>0.0092</b>	<b>0.068</b>	<b>0.005</b>	<b>0.0049</b>	<b>0.0098</b>	<b>0.0078</b>



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 6 0-2in bgs 6/4/2015	Grid 6 2-6in bgs 6/4/2015	Grid 7 0-2in bgs 6/4/2015	Grid 7 2-6in bgs 6/4/2015	Grid 7 6-12in bgs 6/4/2015	Grid 7 12-24in bgs 6/4/2015
<b>Volatile Organic Compounds</b>										
2-Butanone	78-93-3	mg/kg	27000	--	0.019 U	0.013 U	0.011 U	0.011 U	0.0088 U	0.0089 U
Acetone	67-64-1	mg/kg	61000	--	<b>0.025</b>	<b>0.008 LJ</b>	0.011 U	<b>0.0081 LJ</b>	<b>0.0076 LJ</b>	<b>0.01</b>
Ethylbenzene	100-41-4	mg/kg	5.8	--	<b>0.00045 LJ</b>	<b>0.00027 LJ</b>	0.0054 U	0.0055 U	0.0044 U	0.0044 U
m,p-Xylene	108-38-3/106-42-3	mg/kg	550	--	<b>0.0017 LJ</b>	<b>0.00071 LJ</b>	0.0054 U	<b>0.00023 LJ</b>	0.0044 U	0.0044 U
o-Xylene	95-47-6	mg/kg	650	--	<b>0.00064 LJ</b>	0.0067 U	0.0054 U	0.0055 U	0.0044 U	0.0044 U
Toluene	108-88-3	mg/kg	4900	--	<b>0.03</b>	<b>0.018</b>	<b>0.0029 LJ</b>	<b>0.0036 LJ</b>	<b>0.0047</b>	<b>0.0041 LJ</b>

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL

Yellow highlighted cells exceed RSL

U - Not Detected at reported quantitation limit

L - Reported concentration is below the CRQL

mg/kg-milligrams per kilogram

BOLD-indicates a detected concentration

bgs-below ground surface

NA - Not Analyzed

NP - Not Published

J - Estimated Value

R - Unusable

SIM-selected ion monitoring

in-inches



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 8 0-2in bgs 6/4/2015	Grid 8 2-6in bgs 6/4/2015	Grid 8 6-12in bgs 6/4/2015
<b>Metals</b>							
Aluminum	7429-90-5	mg/kg	77000	--	3000	4290	5410
Arsenic	7440-38-2	mg/kg	0.68	--	4.7 J	2.7 J	2.1 J
Barium	7440-39-3	mg/kg	15000	--	37.5	51.1	61.8
Calcium	7440-70-2	mg/kg	NP	--	801	953	1010
Chromium	7440-47-3	mg/kg	NP	--	7.1	9.2	11
Cobalt	7440-48-4	mg/kg	23	--	2.4	3.5	5
Copper	7440-50-8	mg/kg	3100	--	3.5	4.3	4.8
Iron	7439-89-6	mg/kg	55000	--	6090	6950	8920
Lead	7439-92-1	mg/kg	400	--	9.6	8.7	7.9
Magnesium	7439-95-4	mg/kg	NP	--	450	587	675
Manganese	7439-96-5	mg/kg	1800	--	140	155	206
Mercury	7439-97-6	mg/kg	9.4	--	0.023 LJ	0.0056 LJ	0.005 LJ
Nickel	7440-02-0	mg/kg	1500	--	4.3	5.7	7.2
Potassium	7440-09-7	mg/kg	NP	--	528	783	754
Selenium	7782-49-2	mg/kg	390	--	2.4 U	2.3 U	2.2 U
Vanadium	7440-62-2	mg/kg	390	--	10.5	13.9	17.4
Zinc	7440-66-6	mg/kg	23000	--	26.5	23.8	21.7



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 8 0-2in bgs 6/4/2015	Grid 8 2-6in bgs 6/4/2015	Grid 8 6-12in bgs 6/4/2015
<b>Polychlorinated Biphenyls (None Detected)</b>							
<b>Pesticides</b>							
4,4'-DDD	72-54-8	mg/kg	2.3	--	<b>0.00027 LJ</b>	0.0039 U	0.0037 U
4,4'-DDE	72-55-9	mg/kg	2	--	<b>0.00055 LJ</b>	<b>0.00064 LJ</b>	0.0037 U
4,4'-DDT	50-29-3	mg/kg	1.9	--	<b>0.0021 LJ</b>	<b>0.00093 LJ</b>	<b>0.00022 LJ</b>
Aldrin	309-00-2	mg/kg	0.039	--	<b>0.002 J</b>	<b>0.00024 LJ</b>	<b>0.00057 LJ</b>
alpha-BHC	319-84-6	mg/kg	0.086	--	<b>0.00013 LJ</b>	<b>0.000095 LJ</b>	0.0019 U
alpha-Chlordane	5103-71-9	mg/kg	NP	--	0.0019 U	0.002 U	0.0019 U
beta-BHC	319-85-7	mg/kg	0.3	--	<b>0.0014 LJ</b>	0.002 U	0.0019 U
Dieldrin	60-57-1	mg/kg	0.034	--	<b>0.00018 LJ</b>	<b>0.00038 LJ</b>	<b>0.00029 LJ</b>
Endosulfan II	33213-65-9	mg/kg	NP	--	0.0036 U	0.0039 U	0.0037 U
Endosulfan sulfate	1031-07-8	mg/kg	NP	--	0.0036 U	<b>0.0007 LJ</b>	<b>0.00018 LJ</b>
Endrin	72-20-8	mg/kg	19	--	<b>0.00076 LJ</b>	<b>0.0031 LJ</b>	<b>0.00066 LJ</b>
Endrin aldehyde	7421-93-4	mg/kg	NP	--	<b>0.00025 LJ</b>	<b>0.0012 LJ</b>	<b>0.00016 LJ</b>
Endrin ketone	53494-70-5	mg/kg	NP	--	<b>0.0018 LJ</b>	<b>0.0008 LJ</b>	<b>0.00034 LJ</b>
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57	--	0.0019 U	0.002 U	<b>0.00014 LJ</b>
gamma-Chlordane	5103-74-2	mg/kg	NP	--	0.0019 U	0.002 U	0.0019 U
Heptachlor	76-44-8	mg/kg	0.13	--	0.0019 U	0.002 U	0.0019 U
Heptachlor epoxide	1024-57-3	mg/kg	0.07	--	0.0019 U	0.002 U	0.0019 U
Methoxychlor	72-43-5	mg/kg	320	--	<b>0.0028 LJ</b>	0.02 U	<b>0.001 LJ</b>



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 8 0-2in bgs 6/4/2015	Grid 8 2-6in bgs 6/4/2015	Grid 8 6-12in bgs 6/4/2015
<b>Semi-volatile Organic Compounds</b>							
4-Methylphenol	106-44-5	mg/kg	6300	--	0.18 U	0.2 U	0.19 U
4-Nitroaniline	100-01-6	mg/kg	27	--	0.36 U	0.38 U	0.37 U
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39	--	0.18 U	<b>0.22</b>	<b>0.039 LJ</b>
Di-n-butylphthalate	84-74-2	mg/kg	6300	--	0.18 U	0.2 U	0.19 U
<b>Semi-volatile Organic Compounds (SIM)</b>							
2-Methylnaphthalene	91-57-6	mg/kg	240	--	<b>0.00075 LJ</b>	0.0038 U	0.0037 U
Acenaphthylene	208-96-8	mg/kg	NP	--	<b>0.00075 LJ</b>	<b>0.00088 LJ</b>	0.0037 U
Anthracene	120-12-7	mg/kg	18000	--	<b>0.0016 LJ</b>	<b>0.00097 LJ</b>	0.0037 U
Benzo(a)anthracene	56-55-3	mg/kg	0.16	--	<b>0.0024 LJ</b>	<b>0.0036 LJ</b>	<b>0.0018 LJ</b>
Benzo(a)pyrene	50-32-8	mg/kg	0.016	--	<b>0.0018 LJ</b>	<b>0.0031 LJ</b>	<b>0.0014 LJ</b>
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16	--	<b>0.0045</b>	<b>0.0055</b>	<b>0.0033 LJ</b>
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP	--	<b>0.00096 LJ</b>	0.0038 U	0.0037 U
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6	--	<b>0.0012 LJ</b>	<b>0.0016 LJ</b>	<b>0.00094 LJ</b>
Chrysene	218-01-9	mg/kg	16	--	<b>0.0044</b>	<b>0.0056</b>	<b>0.0025 LJ</b>
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016	--	0.0036 U	<b>0.00092 LJ</b>	0.0037 U
Fluoranthene	206-44-0	mg/kg	2400	--	<b>0.0032 LJ</b>	<b>0.0047</b>	<b>0.0027 LJ</b>
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16	--	<b>0.0018 LJ</b>	<b>0.0033 LJ</b>	<b>0.0017 LJ</b>
Naphthalene	91-20-3	mg/kg	3.8	--	0.0036 U	0.0038 U	0.0037 U
Pentachlorophenol	87-86-5	mg/kg	1	--	0.0072 UJv	0.0078 U	0.0075 U
Phenanthrene	85-01-8	mg/kg	NP	--	<b>0.0024 LJ</b>	<b>0.0026 LJ</b>	<b>0.0016 LJ</b>
Pyrene	129-00-0	mg/kg	1800	--	<b>0.0049</b>	<b>0.007</b>	<b>0.0042</b>



**Wilcox Oil  
Soil Analytical Data  
Bristow, OK**

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level	Property 019 Sample ID Depth Date	Grid 8 0-2in bgs 6/4/2015	Grid 8 2-6in bgs 6/4/2015	Grid 8 6-12in bgs 6/4/2015
<b>Volatile Organic Compounds</b>							
2-Butanone	78-93-3	mg/kg	27000	--	0.012 U	0.015 U	0.012 U
Acetone	67-64-1	mg/kg	61000	--	<b>0.007 LJ</b>	0.015 U	<b>0.0055 LJ</b>
Ethylbenzene	100-41-4	mg/kg	5.8	--	0.0059 U	0.0073 U	0.0058 U
m,p-Xylene	108-38-3/106-42-3	mg/kg	550	--	0.0059 U	<b>0.00047 LJ</b>	<b>0.00046 LJ</b>
o-Xylene	95-47-6	mg/kg	650	--	0.0059 U	0.0073 U	0.0058 U
Toluene	108-88-3	mg/kg	4900	--	<b>0.0046 LJ</b>	<b>0.0055 LJ</b>	<b>0.0077</b>

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL

Yellow highlighted cells exceed RSL

U - Not Detected at reported quantitation limit

L - Reported concentration is below the CRQL

mg/kg-milligrams per kilogram

BOLD-indicates a detected concentration

bgs-below ground surface

NA - Not Analyzed

NP - Not Published

J - Estimated Value

R - Unusable

SIM-selected ion monitoring

in-inches



# Enclosure 3: Table 2

Wilcox Oil  
Soil Analytical Data  
Bristow, OK

## Full List of Chemicals Analyzed in the Soil

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level
<b>Metals</b>			
Aluminum	7429-90-5	mg/kg	77000
Antimony	7440-36-0	mg/kg	31
Arsenic	7440-38-2	mg/kg	0.68
Barium	7440-39-3	mg/kg	15000
Beryllium	7440-41-7	mg/kg	160
Cadmium	7440-43-9	mg/kg	71
Calcium	7440-70-2	mg/kg	NP
Chromium	7440-47-3	mg/kg	NP
Cobalt	7440-48-4	mg/kg	23
Copper	7440-50-8	mg/kg	3100
Iron	7439-89-6	mg/kg	55000
Lead	7439-92-1	mg/kg	400
Magnesium	7439-95-4	mg/kg	NP
Manganese	7439-96-5	mg/kg	1800
Mercury	7439-97-6	mg/kg	9.4
Nickel	7440-02-0	mg/kg	1500
Potassium	7440-09-7	mg/kg	NP
Selenium	7782-49-2	mg/kg	390
Silver	7440-22-4	mg/kg	390
Sodium	7440-23-5	mg/kg	NP
Thallium	7440-28-0	mg/kg	0.78
Vanadium	7440-62-2	mg/kg	390
Zinc	7440-66-6	mg/kg	23000
<b>Pesticides</b>			
4,4'-DDD	72-54-8	mg/kg	2.3
4,4'-DDE	72-55-9	mg/kg	2
4,4'-DDT	50-29-3	mg/kg	1.9
Acetophenone	98-86-2	mg/kg	7800
Aldrin	309-00-2	mg/kg	0.039
alpha-BHC	319-84-6	mg/kg	0.086
alpha-Chlordane	5103-71-9	mg/kg	NP
Atrazine	1912-24-9	mg/kg	2.4
Benzaldehyde	100-52-7	mg/kg	7800
beta-BHC	319-85-7	mg/kg	0.3
Caprolactam	105-60-2	mg/kg	31000
Carbazole	86-74-8	mg/kg	NP
delta-BHC	319-86-8	mg/kg	NP
Dieldrin	60-57-1	mg/kg	0.034
Endosulfan I	959-98-8	mg/kg	NP
Endosulfan II	33213-65-9	mg/kg	NP
Endosulfan sulfate	1031-07-8	mg/kg	NP
Endrin	72-20-8	mg/kg	19
Endrin aldehyde	7421-93-4	mg/kg	NP
Endrin ketone	53494-70-5	mg/kg	NP
gamma-BHC (Lindane)	58-89-9	mg/kg	0.57
gamma-Chlordane	5103-74-2	mg/kg	NP
Heptachlor	76-44-8	mg/kg	0.13
Heptachlor epoxide	1024-57-3	mg/kg	0.07
Methoxychlor	72-43-5	mg/kg	320
Toxaphene	8001-35-2	mg/kg	0.49

mg/kg-milligrams per kilogram

NP - Not Published

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level
<b>Polychlorinated Biphenyls</b>			
Aroclor-1016	12674-11-2	mg/kg	4.1
Aroclor-1221	11104-28-2	mg/kg	0.17
Aroclor-1232	11141-16-5	mg/kg	0.17
Aroclor-1242	53469-21-9	mg/kg	0.23
Aroclor-1248	12672-29-6	mg/kg	0.23
Aroclor-1254	11097-69-1	mg/kg	0.24
Aroclor-1260	11096-82-5	mg/kg	0.24
Aroclor-1262	37324-23-5	mg/kg	NP
Aroclor-1268	11100-14-4	mg/kg	NP
<b>Volatile Organic Compounds</b>			
1,1,1-Trichloroethane	71-55-6	mg/kg	8100
1,1,2,2-Tetrachloroethane	79-34-5	mg/kg	0.6
1,1,2-Trichloroethane	79-00-5	mg/kg	1.1
1,1-Dichloroethane	75-34-3	mg/kg	3.6
1,1-Dichloroethene	75-35-4	mg/kg	230
1,2,3-Trichlorobenzene	87-61-6	mg/kg	63
1,2-Dibromo-3-chloropropane	96-12-8	mg/kg	0.0053
1,2-Dibromoethane	106-93-4	mg/kg	0.036
1,2-Dichlorobenzene	95-50-1	mg/kg	1800
1,2-Dichloroethane	107-06-2	mg/kg	0.46
1,2-Dichloropropane	78-87-5	mg/kg	1
1,3-Dichlorobenzene	541-73-1	mg/kg	NP
1,4-Dichlorobenzene	106-46-7	mg/kg	2.6
2-Butanone	78-93-3	mg/kg	27000
2-Hexanone	591-78-6	mg/kg	200
4-Methyl-2-Pentanone	108-10-1	mg/kg	5300
Acetone	67-64-1	mg/kg	61000
Benzene	71-43-2	mg/kg	1.2
Bromochloromethane	74-97-5	mg/kg	150
Bromodichloromethane	75-27-4	mg/kg	0.29
Bromoform	75-25-2	mg/kg	19
Bromomethane	74-83-9	mg/kg	6.8
Carbon disulfide	75-15-0	mg/kg	770
Carbon tetrachloride	56-23-5	mg/kg	0.65
Chlorobenzene	108-90-7	mg/kg	280
Chloroethane	75-00-3	mg/kg	14000
Chloroform	67-66-3	mg/kg	0.32
Chloromethane	74-87-3	mg/kg	110
cis-1,2-Dichloroethene	156-59-2	mg/kg	160
cis-1,3-Dichloropropene	10061-01-5	mg/kg	NP
Cyclohexane	110-82-7	mg/kg	6500
Dibromochloromethane	124-48-1	mg/kg	0.75
Dichlorodifluoromethane	75-71-8	mg/kg	87
Ethylbenzene	100-41-4	mg/kg	5.8
Isopropylbenzene	98-82-8	mg/kg	1900
m,p-Xylene	88-33-3/106-4	mg/kg	550
Methyl acetate	79-20-9	mg/kg	78000
Methyl tert-butyl ether	1634-04-4	mg/kg	47
Methylcyclohexane	108-87-2	mg/kg	NP
Methylene chloride	75-09-2	mg/kg	57
o-Xylene	95-47-6	mg/kg	650
Styrene	100-42-5	mg/kg	6000
Tetrachloroethene	127-18-4	mg/kg	24
Toluene	108-88-3	mg/kg	4900
trans-1,2-Dichloroethene	156-60-5	mg/kg	1600
trans-1,3-Dichloropropene	10061-02-6	mg/kg	NP
Trichloroethene	79-01-6	mg/kg	0.94
Trichlorofluoromethane	75-69-4	mg/kg	730
Vinyl chloride	75-01-4	mg/kg	0.059

# Enclosure 3: Table 2

Wilcox Oil  
Soil Analytical Data  
Bristow, OK

## Full List of Chemicals Analyzed in the Soil

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level
<b>Semi-volatile Organic Compounds</b>			
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	mg/kg	40000
1,1'-Biphenyl	92-52-4	mg/kg	47
1,2,4,5-Tetrachlorobenzene	95-94-3	mg/kg	23
1,2,4-Trichlorobenzene	120-82-1	mg/kg	24
1,4-Dioxane	123-91-1	mg/kg	5.3
2,2'-Oxybis(1-chloropropane)	108-60-1	mg/kg	4.9
2,3,4,6-Tetrachlorophenol	58-90-2	mg/kg	1900
2,4,5-Trichlorophenol	95-95-4	mg/kg	6300
2,4,6-Trichlorophenol	88-06-2	mg/kg	49
2,4-Dichlorophenol	120-83-2	mg/kg	190
2,4-Dimethylphenol	105-67-9	mg/kg	1300
2,4-Dinitrophenol	51-28-5	mg/kg	130
2,4-Dinitrotoluene	121-14-2	mg/kg	1.7
2,6-Dinitrotoluene	606-20-2	mg/kg	0.36
2-Chloronaphthalene	91-58-7	mg/kg	4800
2-Chlorophenol	95-57-8	mg/kg	390
2-Methylnaphthalene	91-57-6	mg/kg	240
2-Methylphenol	95-48-7	mg/kg	3200
2-Nitroaniline	88-74-4	mg/kg	630
2-Nitrophenol	88-75-5	mg/kg	NP
3,3'-Dichlorobenzidine	91-94-1	mg/kg	1.2
3-Nitroaniline	99-09-2	mg/kg	NP
4,6-Dinitro-2-methylphenol	534-52-1	mg/kg	5.1
4-Bromophenyl-phenylether	101-55-3	mg/kg	NP
4-Chloro-3-methylphenol	59-50-7	mg/kg	6300
4-Chloroaniline	106-47-8	mg/kg	2.7
4-Chlorophenyl-phenylether	7005-72-3	mg/kg	NP
4-Methylphenol	106-44-5	mg/kg	6300
4-Nitroaniline	100-01-6	mg/kg	27
4-Nitrophenol	100-02-7	mg/kg	NP
Benzo(a)anthracene	56-55-3	mg/kg	0.16
Benzo(a)pyrene	50-32-8	mg/kg	0.016
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16
Bis(2-chloroethoxy)methane	111-91-1	mg/kg	190
Bis(2-chloroethyl)ether	111-44-4	mg/kg	0.23
Bis(2-ethylhexyl)phthalate	117-81-7	mg/kg	39
Butylbenzylphthalate	85-68-7	mg/kg	290
Chrysene	218-01-9	mg/kg	16
Dibenzofuran	132-64-9	mg/kg	73
Diethylphthalate	84-66-2	mg/kg	51000
Dimethylphthalate	131-11-3	mg/kg	NP
Di-n-butylphthalate	84-74-2	mg/kg	6300
Di-n-octylphthalate	117-84-0	mg/kg	630
Fluoranthene	206-44-0	mg/kg	2400
Hexachlorobenzene	118-74-1	mg/kg	0.21
Hexachlorobutadiene	87-68-3	mg/kg	1.2
Hexachlorocyclopentadiene	77-47-4	mg/kg	1.8
Hexachloroethane	67-72-1	mg/kg	1.8
Isophorone	78-59-1	mg/kg	570
Nitrobenzene	98-95-3	mg/kg	5.1
N-Nitroso-di-n-propylamine	621-64-7	mg/kg	0.078
N-Nitrosodiphenylamine	86-30-6	mg/kg	110
Pentachlorophenol	87-86-5	mg/kg	1
Phenanthrene	85-01-8	mg/kg	NP
Phenol	108-95-2	mg/kg	19000
Pyrene	129-00-0	mg/kg	1800

Analyte	CAS.NO	Units	EPA Residential Soil Screening Level
<b>Semi-volatile Organic Compounds (SIM)</b>			
2-Methylnaphthalene	91-57-6	mg/kg	240
Acenaphthene	83-32-9	mg/kg	3600
Acenaphthylene	208-96-8	mg/kg	NP
Anthracene	120-12-7	mg/kg	18000
Benzo(a)anthracene	56-55-3	mg/kg	0.16
Benzo(a)pyrene	50-32-8	mg/kg	0.016
Benzo(b)fluoranthene	205-99-2	mg/kg	0.16
Benzo(g,h,i)perylene	191-24-2	mg/kg	NP
Benzo(k)fluoranthene	207-08-9	mg/kg	1.6
Chrysene	218-01-9	mg/kg	16
Dibenzo(a,h)anthracene	53-70-3	mg/kg	0.016
Fluoranthene	206-44-0	mg/kg	2400
Fluorene	86-73-7	mg/kg	2400
Indeno(1,2,3-cd)pyrene	193-39-5	mg/kg	0.16
Naphthalene	91-20-3	mg/kg	3.8
Pentachlorophenol	87-86-5	mg/kg	1
Phenanthrene	85-01-8	mg/kg	NP
Pyrene	129-00-0	mg/kg	1800

mg/kg-milligrams per kilogram

SIM-selected ion monitor

NP - Not Published

Residential Soil Screening Level- June 2015 EPA Residential Soil RSL

Enclosure 4: Agency for Toxic Substances and Disease Registry Fact Sheets

**Enclosure 4: Agency for Toxic Substances and Disease Registry fact sheets for Arsenic and Polycyclic Aromatic Hydrocarbons**

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

**HIGHLIGHTS:** Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

## What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

## What happens to arsenic when it enters the environment?

- Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
- Arsenic cannot be destroyed in the environment. It can only change its form.
- Rain and snow remove arsenic dust particles from the air.
- Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
- Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

## How might I be exposed to arsenic?

- Ingesting small amounts present in your food and water or breathing air containing arsenic.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.
- Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

## How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic

# Arsenic

**CAS # 7440-38-2**

compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

## How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

## How can arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

## How can families reduce the risks of exposure to arsenic?

- If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
- If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

- If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

## Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

## Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10  $\mu\text{g}/\text{m}^3$ ) for 8 hour shifts and 40 hour work weeks.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

## Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaqs/index.asp>.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

# Polycyclic Aromatic Hydrocarbons (PAHs) - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

**SUMMARY:** Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

## What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl'ī-sī'klīk ār'ə-măt'īk hī'drə-kar'bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

## What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.

- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

## How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.
- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

# Polycyclic Aromatic Hydrocarbons

## How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

## How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

## Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

## Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m<sup>3</sup>). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m<sup>3</sup> averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m<sup>3</sup> for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

## Glossary

**Carcinogen:** A substance that can cause cancer.

**Ingest:** Take food or drink into your body.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

## Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333.

Phone: 1-800-232-4636.

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